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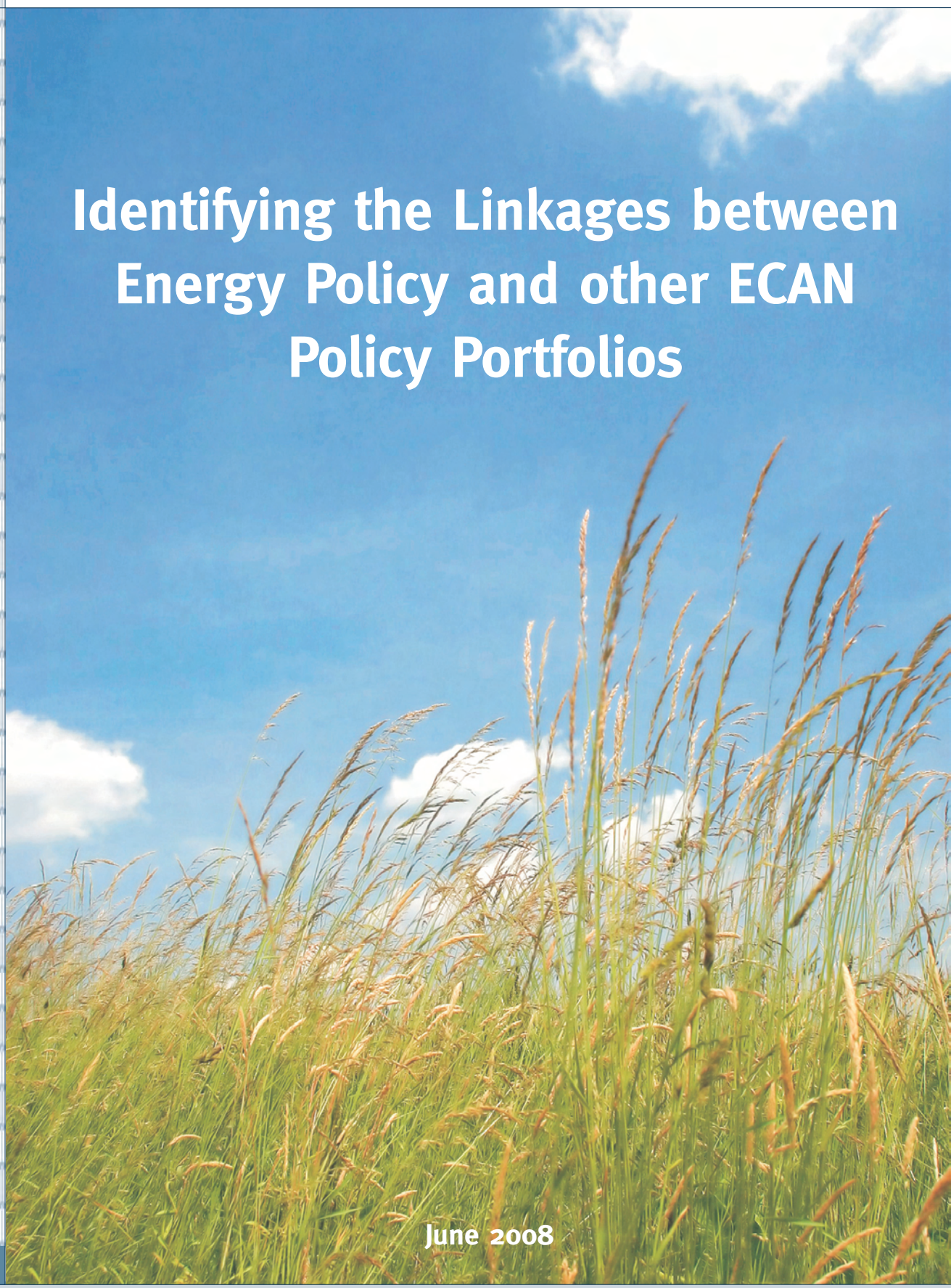
Identifying the Linkages between Energy Policy and other ECAN Policy Portfolios



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Identifying the Linkages between Energy Policy and other ECAN Policy Portfolios

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CAENZ is an independent-think tank and research facilitator funded by grants and sponsorships. CAENZ's mission is to advance social progress and economic growth for New Zealand through broadening national understanding of emerging technologies and facilitating early adoption of advanced technology solutions.

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1 INTRODUCTION

Background[1]

The developed world currently faces a problem of its own creation. The cause of this problem is best summarised by the following quote: *'...we are not only ignorant of what energy is, and the critical role it has played and continues [to play] in economics and politics, but most of us simply don't care about energy.*[2] This was Paul Roberts' description of the American population's attitude to energy, but is equally relevant to all developed economies.

Energy is fundamental to our economy and our everyday lives, yet the extent of our dependence has been largely overlooked. In New Zealand, we have benefited from decades of cheap oil, exceedingly cheap natural gas, and an "apparent" unfettered supply of all consumer energy types (e.g. electricity and transport fuels). For many years as a nation we ignored the inevitability of depletion of current energy stocks without new investment in either exploration or generation. We lost sight of the simple fact that as our demand for energy increased, we would reach a point that the service life of our aging transmission and distribution networks would be placed at risk. We assumed that economic development was reliant on increasing energy supplies, and put little effort into using energy more efficiently. The sense of outrage and lack of confidence that now pervades consumer attitudes toward the energy industry, as a result of oil price rises and the dry year risk to our electricity system, could be simply be described as the manifestation of a socially constructed problem. On top of this there is also public interest and concern in respect of the ongoing use of fossil fuels and the resultant enhanced greenhouse gas emissions to the atmosphere. The issues go further than just energy. Peet and others[3] have argued that we will not address the heart of the energy problem unless due recognition is placed on the resource and ecological constraints of the systems in which we live.

The scale and seriousness of the problem is now evident. Major changes are needed in both the demand and supply side of New Zealand's energy system. The issue is one of transformation, a need for a new approach. To be effective, these new directions will need to be implemented at regional and district levels, and at community and household levels. The government has introduced a number of policy documents that signal a very different approach to energy in New Zealand at a national level, but many energy-related activities are strongly influenced by the policies, plans and initiatives administered at a local government level.

Environment Canterbury's Role

Environment Canterbury (ECAN) is the promotional name for the Canterbury Regional Council, an elected body of 14 councillors. Environment Canterbury states its purpose as being to achieve a sustainable environment, protect from disasters and natural hazards, and ensure safe and efficient movement of people and goods for the benefit of people, communities and future generations, at a reasonable level of monetary and personal cost.

A key role of the council is the promotion of sustainable management of natural and physical resources, primarily under the Resource Management Act 1991 and the Local Government Act 2002, but it has numerous other responsibilities including transportation planning and hazard management. The council is responsible for matters that have more than just local significance (those are the tasks of the city and district councils).

Canterbury is one of the fastest growing regions in New Zealand. As it grows, it puts pressure on the systems that supply energy to the region. The demand for energy arises primarily from households, industry, agriculture,

[1] This section draws heavily from a presentation given by Mike O'Connell (ECAN) and George Hooper (CAENZ) given at the EEA Annual Conference 2006, entitled Energy into the future: Creating a long-term balance between energy planning and desired community outcomes.

[2] Roberts P 2004, 'The End of Oil: on the edge of a perilous new world', Houghton Mifflin Company, Boston. MA

[3] Peet J 2005, Sustainable Energy: is sustainable attainable?, Future Times, Vol. 2, 6-9

manufacturing and transport. The majority of energy consumed in Canterbury is supplied from fossil fuels (68%) - a consistent percentage over the period 1982 -2006. The patterns and levels of energy consumption in the region are broadly similar to those seen nationally, with the following differences:

- Per capita electricity consumption is higher.
- Per capita transport energy consumption is higher.
- The industrial/commercial share of total energy consumption is lower.
- Residential consumption per household is slightly higher.
- Electricity usage continues to grow at a consistent rate of 2.9 % per annum compared to the national average of 2.6 % per annum.

More details can be found in Appendix A.

ECAN currently has a draft Environment Canterbury Energy Strategy, but the implementation of ECAN's other policy documents can also have a significant impact/influence on how energy is used in the Canterbury region, and how energy generation and transmission is planned and developed.

The Brief

This report was commissioned by ECAN to better understand how energy is addressed through its current policy portfolios, and the inter-relationships between energy and other portfolios (particularly water, land use and air quality).

The Team

The team working on this report were:

- Scott Caldwell (Centre for Advanced Engineering)
- Nikki Newham (Centre for Advanced Engineering)
- Dr Janet Stephenson (University of Otago)
- Ceri Warnock (University of Otago)

We would like to thank our peer reviewers, Dr George Hooper and Associate Professor Bob Lloyd, for their helpful comments.

2 THE APPROACH

The approach taken in carrying out this study has been to first consider the range of potential problems that might exist in relation to the current assemblage of ECAN's policies and plans, and the adverse outcomes that might result. These potential problems are as follows:

Potential Problem Type A: Some policies may result in significant increases in energy use with no consideration for energy efficiency. *Result: outcomes not consistent with sustainable energy.*

Potential Problem Type B: Policy documents may fail to address energy issues that are within their domain. *Result: shortfall in coverage of issues.*

Potential Problem Type C: Policy mechanisms in one document could unwittingly produce energy/climate change outcomes that were at odds with the outcomes sought in another document. *Result: policy contradictions; unintended consequences.*

Potential Problem Type D: While each document is able to influence part of the 'energy puzzle', as a whole they may not necessarily address energy issues in an integrated way. *Result: fragmented approach, gaps in policy coverage, flawed policy.*

Potential Problem Type E: Policy documents are outdated. This would occur if regional policy documents were developed prior to the many recent changes in national-level policy relating to energy, including:

- national policy introduced 2007-8 (NZES, NZEECS, UNZTS etc);
- new National Policy Statement on Electricity Transmission (2008); and
- changes to section 7 RMA (effective from 2 March 2004) which inserted references to energy into Part II RMA.

Result: plans and policies out of date, lack of relevance to current issues.

Having set out this framework for analysis of ECAN's policies and plans, the following steps were undertaken:

– a high-level review of the region's energy situation (see appendix A);

– scoping of the content of relevant new national strategies and policies relating to energy and climate change (see section 3);

– a high-level review of relevant ECAN plans and policy documents was made to identify firstly how they approached energy issues (section 4), and secondly whether Type A-E problems could be identified (sections 5-7)[4]; and

– development of recommendations.

4 This review was greatly assisted by input from the following ECAN policy staff at a half-day workshop on 17 May 2008: Mike O'Connell (Energy Policy Analyst), Richard Ball (Group Manager, Policy Implementation and Effectiveness), Frank Stewart (Senior Policy Analyst), Neil Pilbrow (Corporate Programmes Manager), Robert Woods (Transport Policy Analyst), Linda Kirk (Programme Manager, Air Quality and Energy), Ray Maw (Planning Team Leader, Environmental Flow Review) , Anna Veltman (Senior Resource Management Planner), Christina Robb (Programme Manager Water), Jon Mitchell (Civil Defence Emergency Management Planner), Toby Lang (Resource Management Planner).

3 THE NEW STRATEGIC POLICY ENVIRONMENT

Over the past year (2007) the New Zealand government has released a number of strategic policy documents which aim to address New Zealand's energy and climate change challenges and its commitments under the Kyoto protocol. These include:

(a) the NZ Energy Strategy[5]

(b) the NZ Energy Efficiency and Conservation Strategy[6],

(c) the draft Update of the NZ Transport Strategy[7] (due for completion mid 2008),

(d) New Zealand's Climate Change Solutions[8],

(e) the Framework for a New Zealand Emissions Trading Scheme[9],

(f) the National Policy Statement on Electricity Transmission[10]

(g) and an upcoming National Policy Statement on Renewable Electricity Generation[11].

Other documents that may influence the energy systems, but not are directly reviewed here, include:

(a) Changes to the Electricity Regulations with regards Distributed Generation[12] and the Electricity Commission[13], ref

(b) The Building Act (2004) and the new amendments under consideration, with reference to "*the need to facilitate the efficient use of energy and energy conservation and the use of renewable sources of energy in buildings*".

Together, these NZ government documents lay out a framework with a clear focus on sustainability, renewable energy, demand management, and the links between energy use and greenhouse gas emissions. The government's desired approach is to address these challenges across all sectors in an integrated way using a wide range of mechanisms including regulation, markets, education, investment and planning. This new strategic policy environment has implications for other policy areas such as economic development, transport and resource management.

The main policy themes of these documents are summarised below.

3.1 New Zealand Energy Strategy

The New Zealand Energy Strategy (NZES) sets out the government's vision for a sustainable, low carbon future for the country. This is summarised in relation to the five key policy planks:

Resilient, low carbon transport

Policy initiatives around transport are motivated primarily by the desire to reduce carbon emissions while improving accessibility and economic development. The planned initiatives and policy directions include:

- Encouragement and support of lower impact and efficient transport modes including cycling and walking.
- Support for development and use of biofuels in order to reduce emissions and reduce reliance on oil imports.
- Support for the wide scale introduction of electric cars to reduce emissions and reduce dependence on oil imports.
- Managing demand for travel through good planning and improving access to public transport.

5 NZ Government 2007, New Zealand Energy Strategy. Ministry of Economic Development, Wellington.

6 NZ Government 2007, New Zealand Energy Efficiency and Conservation Strategy. Energy Efficiency and Conservation Authority, Wellington.

7 New Zealand Government 2007, Sustainable transport – Update of the New Zealand transport Strategy, Ministry of Transport, Wellington.

8 New Zealand Government 2007, New Zealand's Climate Change Solutions, Ministry for the Environment, Wellington.

9 New Zealand Government 2007, The Framework for a New Zealand Emissions trading Scheme, Ministry for the Environment, Wellington.

10 New Zealand Government (Gaz. 13 March 2008) National Policy Statement on Electricity Transmission, Ministry for the Environment, Wellington.

11 See www.mfe.govt.nz/rma/central/nps/generation.html.

12 The Electricity Governance (Connection of Distributed Generation) Regulations 2007 were made under section 172D(1)(10).

13 The Electricity Commission is a Crown entity set up under the Electricity Act to oversee New Zealand's electricity industry and markets. It began operating in September 2003.

Security of electricity supply

A more secure electricity supply involves reducing reliance on the use of fossil fuels to generate electricity. The NZES sets a target to significantly increase the use of renewable technologies for electricity production. Other initiatives include supporting the development of a wholesale gas market and supporting introduction of and improving demand side response initiatives (such as smart metering and energy efficiency investments).

Low emissions power and heat

The NZES aims to achieve 90% of electricity produced from renewable sources by 2025 (up from around 62% today). This will be achieved through the economic framework, market interventions, infrastructure and regulation. Regulatory methods include a National Policy Statement on Electricity Transmission (released March 2008), a National Policy Statement on renewable generation (under development) and a proposed 10-year moratorium on new thermal generation sources (currently with Select Committee). The government has also decided to introduce an Emissions Trading Scheme (ETS) as its core price-based measure for reducing New Zealand's greenhouse gas emissions.

Small-scale local generation (distributed generation) is recognised as having the potential to making a valuable contribution, particularly for more isolated areas. Regulatory barriers to this have been addressed with the new electricity regulations. Direct use of local energy resources (e.g. biomass, geothermal energy, co-generation) for heat will also be encouraged.

Using energy more efficiently

The NZES recognises that energy efficiency measures can be an effective way of dealing with energy demand compared to building new generation capacity. These can be more cost-effective in the long run and can achieve allied benefits (e.g. health benefits of home insulation). Implementation includes a range of 'Energywise' programmes run by EECA (e.g. Energywise homes, Energywise business) plus direct investment by the Electricity Commission and Transpower (who combined spend 5 times more than EECA on energy efficiency). The government also intends to clarify roles for energy efficiency policy development and programme delivery. The government also intends to have a significant impact on fossil fuel energy usage with the implementation of vehicle standards and vehicle efficiency labelling. Local government can play a role through the RMA, and in making decisions on urban form and transport planning which can influence transport energy usage.

More detail is provided in the NZ Energy Efficiency and Conservation Strategy.

Sustainable Technologies and Innovation

The NZES recognises that no single technology will achieve the country's energy goals by itself but that a range of changes must be adopted and implemented. The changes suggested range from increasing renewable energy supplies to new transport technologies such as electric cars and improving energy efficiency. The NZES supports higher levels of research and innovation in energy efficiency improvements and supply technologies. As part of the government's support for technology innovation, funding has been made available to bring forward deployment of marine electricity generation devices, and to support development and implementation of low carbon technologies.

Affordability and Wellbeing

The NZES states that all New Zealander's should be able to afford to heat and light their home. Policy measures suggested include ensuring competitiveness in energy markets to achieve fair and affordable energy prices, varying the low fixed charge to take into account regional variations in climate, and introducing measures to reduce the cost impact of the Emissions Trading Scheme on modest income households.

Implications for local government:

The NZES states (p43):

With regulatory and planning responsibilities across areas such as public transport, urban design, resource management and community awareness, local government has an

important role in realising the ambition of the NZES.

The framework for engagement and partnership with local government is intended to promote constructive cooperation and communication between central and local government on further developing the initiatives in key areas of the NZES. The focus will be on areas where the achievement of national objectives depends on the decisions and actions taken at a local level, particularly in those areas that have no working partnerships at present. The primary aim is to ensure local government input in designing NZES programmes that fall within the regulatory, planning and delivery functions of local government.

Most contact between central government and local government is expected to continue to be carried out on a bilateral or multilateral basis between agencies that deal on a day-to-day basis with the issues at stake. However, some central coordination across the multiple programmes included in the NZES will be useful. Central government agencies will continue the dialogue with local government in developing the framework.

3.2 New Zealand Energy Efficiency and Conservation Strategy

The NZEECS sits alongside the NZ Energy Strategy, with a particular focus on increasing energy efficiency. The NZEECS targets actions in five areas:

Energywise Homes

Includes interest free loans for insulation upgrades, insulation retrofits for low income households, clean heat upgrades to improve air quality, aiming for 15,00-20,000 solar water heating systems by 2010 and introducing Minimum Energy Performance Standards (MEPS) for appliances and energy products.

Energywise Business

Includes energy efficiency training for workers, increasing use of woody biomass and geothermal for energy generation, measuring and implementing energy efficiency measures in the rural sector by the end of 2008 and plans to increase uptake of energy efficiency measures in tourism industries.

Energywise Transport

Includes targets for significant reductions, per capita, of greenhouse gas emissions; being a world leader in deploying electric vehicles; cutting the distance travelled by single occupancy vehicles in urban areas by 10% per capita by 2015; 80% of vehicles being capable of running a 10% biofuel blend by 2015; increasing the fuel efficiency of transport fleet; and investigating electrification of North Island main trunk line by 2010.

New Zealand's efficient and renewable electricity system

The target is to have 90% of electricity generation from renewable sources by 2025.

Government leading the way

Six core government agencies to be carbon neutral by 2012, public service vehicle fleet emissions reduced by 25% by 2012, 10% reduction in energy per employee in core public service buildings, reducing workplace travel, reduce use of energy intensive consumables e.g. paper and support local government in delivery the NZES and NZEECS.

Implications for local government:

The NZEECS states (p77-78):

Local government has vital communications links with local householders, businesses and the energy industry that can be used to help implement many of this strategy's programmes and actions. It can also influence this strategy's objectives through its administration of the Resource Management Act, the Building Code, Regional Land Transport Strategies, responsibilities for public transport and travel demand management.

Local government, and its various subsidiaries, can be large users of energy; for example, when powering water treatment and supply systems. It has the opportunity to showcase best practice in sustainable

energy technology and practices to its communities of interest. Many local authorities are already doing so and are leading the way through developing their own energy strategies and participating in the Communities for Climate Protection (CCP) programme.

The 2005 amendments to the RMA empowered regional councils with a measure of responsibility for planning for the strategic integration of electricity infrastructure and land use. This provides regional councils with a mandate to plan for their region's future renewable energy infrastructure requirements. Allowance for these new requirements can be made in second-generation Regional Policy Statements or, preferably earlier, through specific changes to plans.

Other examples of local government taking action include integrating travel demand management into transport strategies and helping government to deliver the Energywise home grants programme.

Suggested local government actions in NZEECS:

- *Establish the NZES/NZEECS framework for engagement and partnership – Promote co-operation and communication between central and local government in key areas of the energy strategies. The primary aim is to ensure local government input in designing programmes that fall within the regulatory, planning and delivery functions of local government.*
- *Support energy strategy development and RMA policy and plan making – Provide support for local government initiatives to develop energy strategies and RMA policies and plans relating to energy matters.*
- *Building Code amendments – Work with local government to assist them to implement the energy efficiency activities in the Building Code, with a particular focus on removing regulatory barriers and lowering compliance costs.*
- *Develop best practice tools and information for sustainable procurement – For all agencies, including local government, to use, by December 2007.*
- *Energy efficiency promotion – Through the Sustainable Households Programme, local government will be provided with advice and support to help promote energy efficiency and sustainability.*

Note: An action point in NZEECS (p73) states that government will support the development by local government of energy strategies and energy-related RMA policy and plan making, with support programmes established by the end of 2008 (noted as under consideration).

3.3 New Zealand's Climate Change Solutions and The Framework for an New Zealand Emissions Trading Scheme

These documents define New Zealand's 'path to carbon neutrality', signalled by the following targets:

- By 2025, 90% of NZ's electricity generation will be from renewable sources.
- By 2040, NZ's per capita transport greenhouse gas emissions will be reduced by half of those in 2007.
- NZ will be one of the first countries in the world to widely deploy electric vehicles.
- NZ will remain a world leader in agricultural emissions reduction research.

A key plank is the Emissions Trading Scheme (ETS). This is designed to reduce greenhouse gas emissions, increase carbon sinks such as forestry, and increase energy efficiency investment in key sectors (forestry, transport, energy generation, industrial emissions, agriculture and waste). The ETS will introduce, in a staged way, a cap on emissions of greenhouse gases (GHGs) for these sectors. Participants must surrender one emission unit for each tonne of GHG emissions in any given compliance period (usually 1 year). Emission units can be earned through engaging in activities that reduce GHG emissions (e.g. new forest plantings). Emis-

sion units are tradable nationally and internationally, which will set the value of the units. Proposed legislation to implement these initiatives was before the House at the time of writing this report.

Implications for local government:

Many of the implications of the Climate Change strategy for local authorities are the same as those outlined in the NZES and NZEECS.

The staged introduction of the ETS is likely to lead to changes in land use, transport, and energy production and use. At this stage the nature and scale of these changes are unclear, but they may have implications for regional planning in the long term (e.g. more compact urban form, more forest planting, more wind farms).

3.4 Sustainable Transport - update of the New Zealand Transport Strategy (UNZTS)

The UNZTS follows from the NZ Transport Strategy (2004) which set five high-level objectives for the transport sector: Assisting economic development, Assisting safety and personal security, Improving access and mobility, Protecting and promoting public health, and Ensuring environmental sustainability.

The UNZTS will place some definitive policy targets for the transport sector, closely aligned with the government's directions on energy and climate change. The draft UNZTS goals include:

- Manage demand for travel
- Shift to more efficient and/or lower impact means of transport
- Improve the fuel efficiency of the vehicle fleet
- Develop and adopt future fuels
- Ensure the security of short-term oil supplies and a diverse supply of transport fuels.

Draft targets for 2040 include:

- Halve per capita domestic transport greenhouse gas emissions.
- Become one of the first countries in the world to widely deploy electric vehicles.
- Biofuels sales obligation starting at .53% in 2008 increasing to 3.4% of annual petrol and diesel sales by 2012.
- Reduce kilometres travelled by single occupancy vehicles by 10% per capita by 2015 compared to 2007.
- Lift coastal shipping's share of inter-regional freight to around 30% (currently around 15%).
- Lift rail's share of domestic freight to around 25% (currently around 18%).
- At least double public transport mode share to 7% of passenger trips (currently 2-3%).
- increase walking and cycling to 30% of total trips in urban areas (currently around 17%).

Implications for local government:

From discussion paper Sustainable Transport (p20):

Central and local government and t ransport agencies will need to work together to ensure national, regional and local strategies are aligned and achievable. An indicative list of policies and strategies is below

Vehicle fleet policies:

- *harmful emissions*
- *fuel economy*
- *vehicle safety*

Regional land transport strategies (Local Government strategies)

Growth management strategies (Local Government strategies)

Road safety strategy

National State Highway Strategy

National Rail Strategy

Domestic sea freight strategy

Walking and cycling strategy

National guidance on urban design

Some of these policies and strategies will result in legislation, regulation, education,

charging regimes, and consenting processes to assess public and private sector transport developments. Other policies and strategies will be used as the basis for particular investment programmes by central government and local government, all with the intention of achieving a long-term sustainable transport system for New Zealand.

3.5 National Policy Statement on Electricity Transmission (NPSET)

National Policy Statements are developed under the provisions of the Resource Management Act, with the purpose of stating objectives and policies for matters of national significance that are relevant to achieving the purpose of the Act.

The objective of the NPSET is to facilitate the operation, maintenance and upgrade of the existing transmission network and establishment of new transmission resources. The policies recognise the national, regional and local benefits of the transmission network, to manage their environmental effects, and seek to manage the adverse effects of third parties on the network (e.g. reverse sensitivity, buffer corridors). Policy 14 requires that regional councils must include objectives, policies and methods to facilitate long-term planning for investment in transmission infrastructure, and its integration with land uses.

Implications for local government:

Under the RMA 1991 (s55), local authorities must amend their plans and policy statements to give effect to a provision in a national policy statement, within the time specified in the national policy statement - in this case within four years of the NPSET coming into effect. (See also section 3.8 below.)

3.6 National Policy Statement on Renewable Electricity Generation (in progress)

The government is currently developing a National Policy Statement on renewable electricity generation. This will set out the Government's objectives for future energy development in New Zealand, and guide competing values surrounding the benefits of renewable energy in light of local environmental impacts. The proposed policy statement will ready for public comment by the end of June 2008.

Implications for local government:

Once the NPS is introduced, implications are as for 3.5 above.

3.7 Amendments to Section 7 RMA

In 2004 the government introduced two significant changes to Part II of the RMA (Purpose and Principles) relating to energy. Section 7 of the RMA now requires 'all persons exercising functions and powers' under the Act, in relation to managing the use, development and protection of natural and physical resources, to have particular regard to:

- 7(ba) the efficiency of the end use of energy; and
- 7(j) the benefits to be derived from the use and development of renewable energy.

All regional plans and policy statements are required to de developed in accordance with the provisions of Part II (see s 61(1) and s66(1)).

Implications for local government:

When plans and policy statements are reviewed, sections 7(ba) and 7(j) must be given 'particular regard' (s7 RMA).

3.8 Giving effect to national policies and strategies

The Resource Management Act provides comprehensive directives as to how regional councils should approach central government priorities. Under the RMA, regional policy statements must "give effect" to any national policy statement (s 62(3)). Regional plans must also "give effect" to any national policy statement (s 67(3)(a)) and any regional policy

statement (s 67 (3)(b)).

This means that where there is a new or amended national policy statement (e.g. in respect of Electricity Transmission or Renewable Energy) the regional council must review its Regional Policy Statement and Natural Resources Regional Plan to ensure that these give effect to the NPS. In addition, if there is a new regional policy statement, the regional council *must* amend the regional plan if the RPS contains "a provision to which the plan does not give effect", either within the timeframe stated in the RPS or as soon as is reasonably practicable (RMA s 65(6)).

In terms of other national strategies, the RMA states that when a regional council is preparing or changing a RPS or a regional plan, the council shall "have regard" to any "strategies prepared under other Acts" (ss 61(2)(a) and 66(2)(c)).

For completeness, the purpose of the regional plan is to help the regional council carry out any of its functions to achieve the purpose of the RMA (s 63(1)) i.e. as set out in part II, so that includes s 7 (ba), (j).

Complementary to the RMA, the Local Government Act 2002 equips the regional council with the power of general competence (s 12) to achieve the purpose of that Act (i.e. s 10 "to promote the social, economic, environmental, and cultural well-being of communities, in the present and for the future").

In terms of climate change, the RMA expressly addresses regional councils' powers to promulgate rules addressing the discharge of greenhouse gas emissions (GHG). Section 70 A of the RMA states that a regional council must not have regard to the effect of such a discharge on climate change, except to the extent that the use and development of renewable energy enables a reduction in the discharge into air of GHG either (a) in absolute terms or (b) relative to the use and development of non-renewable energy. The correct interpretation of this section is to be determined by the Supreme Court imminently but at present, the Court of Appeal decision in *Genesis Power Ltd v Greenpeace NZ Inc* [2007] NZCA 569 states that whilst councils can look favorably on renewable energy projects, a council could not take into account the contribution to climate change made by non-renewable energy projects in determining consents or making planning decisions.

Controlling GHG is a matter to be dealt with nationally as opposed to regionally, hence the reason for the Climate Change (Emissions Trading and Renewable Preference) Bill. The Court of Appeal did acknowledge that (putting aside the issue as to greenhouse gas emissions, and in accordance with s 7(j) of the Act) it may however be possible for consent authorities and planning bodies to compare the other benefits associated with renewable energy (for example, less localised pollution, and, in the case of biomass-based co-generation, reduction in waste management burdens) against corresponding adverse effects associated with non-renewable energy production.

4 ECAN'S REGIONAL POLICY DOCUMENTS

ECAN is operating in a very different national policy environment to that which existed a few years ago, particularly with regards energy and associated climate change issues. Additionally, regions are affected by the same energy-related trends to which the national strategies are responding – climate change, energy security, etc – and will need to ensure that regional policies are appropriate to these emerging challenges.

There are a number of Environment Canterbury regional policy documents that have some bearing on regional-level energy issues. These include statutory plans and policy documents developed under the Resource Management Act, the Local Government Act, and the Land Transport Act. There are also several non-statutory strategies that influence the region's approach to energy. The current content of each of these plans and policies, as they relate to energy, is discussed in the following sections.

[Note: While district-level statutory planning documents (e.g. district plans) also have a strong influence on energy production and consumption, the brief did not require consideration of these.]

4.1 Statutory regional plans and policies

The key statutory regional policies and plans that relate to energy are the Regional Land Transport Strategy; the Regional Policy Statement and Natural Resources Regional Plan, and the Long Term Council Community Plan. These are provided for under three different statutes, as shown in Figure 1.

The following sections outline the main provisions in these documents that relate to energy.

4.1.1 Canterbury Regional Policy Statement 1998 (CRPS)

The CRPS is required to give an overview of resource management issues for a region, and set out how to achieve sustainable management of natural and physical resources in an integrated way. It provides high-level policies that are largely to be effected through regional plans and district plans.

The current CRPS for Canterbury identifies two main issues relating to energy. The first is the region's dependence on non-sustainable energy sources. The second is the adverse global and regional environmental effects from the use of energy, including air pollution, loss of land, effects on Maori ancestral lands, sites and other taonga, loss of recreational values, landscape effects, human health effects and effects on natural and physical resources.

The CRPS objective in relation to the first issue is to *reduce Canterbury's dependence on non-sustainable energy sources* (14.2). Related

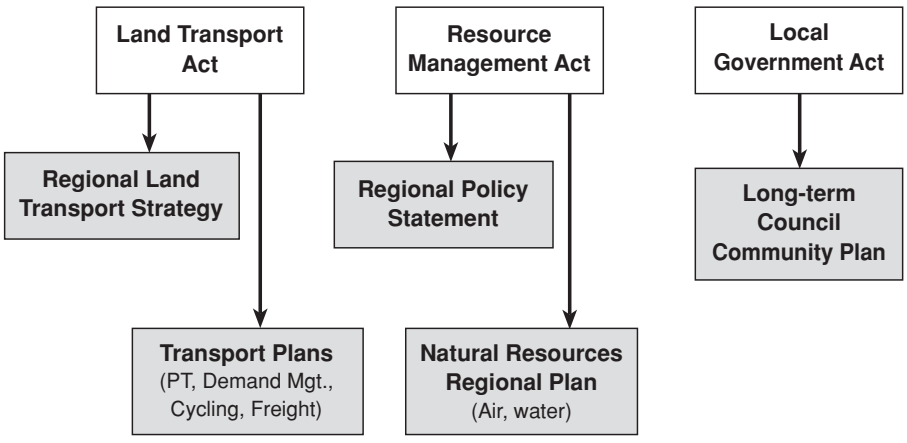


Figure 1: Current Statutory regional plans and policies that can affect energy usage

policies (p222-224) are to:

1. *Promote the use of energy from renewable sources, including the promotion of the substitution of fossil fuels with renewable sources.*
2. *Promote energy conservation and efficient energy use.*
3. *To enable existing hydro-electricity infrastructure in the region to be maintained, upgraded and enhanced.*

The first two policies are to some extent picked up through transport planning and services, through advocacy, and in the draft regional energy strategy. The third policy is implemented via the Natural Resources Regional Plan (see below).

The second energy-related issue of *the adverse effects of energy use* (p224) is not addressed by any specific objective in the CRPS. Other parts of the CRPS deal with effects mitigation (e.g. water, air).

The following CRPS policies (p189-194) relating to the built environment address energy issues:

Policy 1: Promote settlement and transport patterns and built environments that will:

(a) result in increasingly effective and efficient use of resources, particularly energy.

(b) reduce the rate of use of non-renewable energy sources.

(d) incorporate energy efficient approaches to building orientation, form and design.

Policy 3: Encourage settlement patterns that will make efficient use of the regional transport network.

Policy 4: The use of land for urban development and the physical expansion of settlements should be discouraged where such use would adversely affect the operation, efficient use and development of [the region's infrastructure].

The following CRPS policy for transport (p235) has some implications for energy:

Policy 3: Promote changes in movement patterns, travel habits and the location of activities, which achieve a safe, efficient and cost-effective use of the transport infrastructure and reduce the demand for transport.

Overall, the CRPS as it stands currently has limited overt recognition of energy issues compared with the coverage in national-level strategies.

Review of CRPS energy chapter

The CRPS energy chapter is currently under review and on 16 June 2008, a proposal was put by CRPS review staff to ECAN Directors. The direction proposed is that the CRPS will address the following resource management issues in relation to energy:

1. Security of energy supply – this would cover the following sub issues:
    a. Existing generation (infrastructure and other conditions such as water allocation for energy generation).
    b. Existing transmission including reverse sensitivity and providing for maintenance.
    c. New generation – General, including peak loading, distributed network and co-generation.
    d. New generation – Renewable energy inclusion the promotion of renewables. Can make some hard calls under this issue heading, i.e. for new hydro preference towards rivers that are already compromised in their natural and amenity values (i.e. Waitaki and Coleridge).
    e. New transmission, including giving effect to the National Policy Statement on Electricity Transmission.
    f. Other energy distribution (i.e. oil & gas based energy) including localised storage provision, distributed local storage and security of supply during natural disaster events.
2. Efficient end use of energy including:
    a. Transport efficiency – mode choice, trip distance etc.
    b. Buildings – including passive and active energy gains (solar gain / orientation, insulation, micro generation).
    c. Efficiency gains across residential, agricultural, industrial and commercial sectors through such measures as energy reuse, co-benefits (i.e. micro

hydro in irrigation canals, methane capture from sewerage treatment), energy capture.

3. The adverse local and regional effects that result from the production and use of energy.

In addition to the three issues identified above, it is also considered that existing Issue 2 remains relevant and should be retained but will need to be adapted slightly (to remove reference to global effects of the use and production of energy).

4.1.2 Natural Resources Regional Plan 2002, 2004 (NRRP)

The NRRP contains objectives, policies and methods for the sustainable management of the region's natural resources, including air quality, water quality, water quantity, wetlands, soil conservation, and the beds of lakes and rivers. This section outlines the main provisions in the NRRP that relate to energy issues.

Chapter 3 - Air Quality

Being effects-based, this chapter focuses on controlling emissions. The main issues considered are emissions from industry, agriculture, transport and home heating. The provisions do not directly relate to energy but have implications for energy use and energy production wherever this involves emissions to air. The objectives seek to:

- Set urban ambient air quality standards based on adverse health and nuisance effects.
- Maintain high existing ambient air quality.
- Promote reduced emissions from carbon-based fuels.
- Set standards, conditions and terms for discharges of contaminants into the air.
- Avoid chemical spray drift and consequent contamination of water.
- Encourage activities that require discharge consents to locate away from residences and public buildings.
- Avoid encroachment of new development on existing activities discharging to air.
- Adopt waste management practices that reduce adverse effects of methane and other contaminants.
- Encourage vegetation cover that absorbs significant amounts of atmospheric carbon dioxide.
- Promote measures to reduce the amount of stratospheric ozone depleting substances released into the atmosphere.

The main energy-relevant provisions relate to residential heating. Under the objectives for ambient air quality in Canterbury, the plan:

- Sets emission standards for enclosed burners.
- Sets emission standards for large scale fuel burning devices.

Rules relating to domestic heating prohibit open fires; phase out older style enclosed burners and reduce the number of enclosed burners. Rules preventing new homes from having solid fuels burners are currently under appeal.

Chapter 5 – Water Quantity

This chapter deals with the allocation of water and maintenance of minimum water flows. As with air, energy is not directly mentioned but the provisions have implications for the use of water for energy production.

The main relevant policies are:

- Water flow and level regimes established first. Water available above these regimes is allocated to maximise wellbeing and enhance water availability.
- Promote efficiency in the use of water.
- New point source discharges should not preclude existing uses.
- New permits to take water are to specify maximum usage, be based on actual needs, provide mechanisms to restrict abstractions, and give priority to existing water permit holders and domestic needs
- Set standards to maintain, or improve water quality.
- Promote land uses which maintain and where appropriate enhance water quality.

The NRRP sets out environmental limits in relation to water abstraction, which in the long run will constrain land use changes on the basis of water availability. It provides strong protection for existing water users (including hydro power stations). Allocation limits are set

but there is no priority setting for users – consents are processed on a first come, first served basis.

In relation to objectives for allocation of the available water resource, policies and rules cover:

- Allocation regimes for surface and groundwater.
- Reasonable and efficient use of water.

Water allocation is also covered on a more localised basis in the Waitaki Catchment Plan and the Waimakariri and Opihi River Plans.

These provisions have a direct impact on the use of water for new and existing hydro power generation, and an indirect impact on energy use through enabling activities such as pumping and irrigation.

4.1.3 Regional Land Transport Strategy 2005-2015 (RLTS)

The RLTS is the overarching transport strategy for the region. Alongside this are the Regional Passenger Transport Plan, the Regional Demand Management Plan and cycling and freight management plans (not reviewed here).

The RLTS identifies the region's transports needs, the roles of all land transport modes and details how planning, engineering, education, encouragement and enforcement methods are to be used to provide for future transport needs. The focus is largely on supporting economic development through improving traffic flows, with energy use a minor consideration.

The RLTS vision is for a transport system that:

- provides equitable access for all sectors of the community;
- supports a thriving economy;
- promotes a social environment which is safe and supportive;
- is consistent with a healthy, pleasant and pollution-free environment;
- is safe to use;
- involves community participation in land transport decision-making;
- is part of an integrated planning framework; and
- is innovative and responsive to change.

The statement of trends and issues does not specifically include reference to energy issues or the climate change implications of transport use.

In order to achieve the visions of the RLTS five key result areas (KRA) have been identified. These are:

- Alternative modes of transport (e.g. walking, cycling, public transport).
- Road upgrades to address congestion.
- Demand management.
- Land use (e.g. compact urban form).
- Freight systems.

Within each key result area, a number of guiding policies, methods and activities provide the means with which to achieve the vision of the RLTS. Energy efficiency is implicit in these KRA's rather than explicit. There are no policies around shipping and rail.

The RLTS is currently being updated to take into account the Greater Christchurch Urban Development Strategy.

4.1.4 Long Term Council Community Plan 2006 - 2016 (LTCCP)

The LTCCP sets out the activities and services that the Regional Council intends to provide for the following 10-year period. The LTCCP is reviewed every 3 years and the new Draft Annual Plan is generated using the LTCCP as a basis. Planning is already under way for the period 2009-2019.

ECAN's LTCCP identifies four main Community Outcomes, which guide all of Council's activities:

- Social well-being: 'Living the good life in Canterbury'.
- Economic well-being: 'Prospering in Canterbury'.
- Environmental well-being: 'Caring for Canterbury'.
- Cultural well-being: 'Vibrant exciting Canterbury'.

Its 'Strategic Directions' are:

- Strong Communities.

- Healthy Environment.
- Liveable City.
- Prosperous Economy.

None of these specifically refer to energy, although a sustainable and affordable energy supply underpins all of these aspirations, particularly that of a prosperous economy.

The LTCCP identifies activities to be undertaken over the 10-year timeframe of the plan, some of which relate directly to energy. Specific activities identified in the 2006/07 plan are as follows, although it should be noted that these priorities may change in the Annual Plan.

1. Investigations

2006/07 - 2015/16

Undertake energy audits with partner organisations.

Investigate energy-efficiency initiatives.

2. Policy making and planning

2006/07

Progress the draft Regional Energy Strategy through its statutory processes. [It is unclear what is meant here, as the draft Regional Energy Strategy is not a statutory document.]

2006/07 to 2015/16

Work with key agencies to improve energy efficiency.

Ensure consistency between district and city plans and regional policies for managing energy.

2009/10, 2012/13 and 2015/16

Review the Regional Energy Strategy.

2008/09, 2011/12 and 2014/15

Assess the effectiveness and efficiency of the Regional Energy Strategy.

3. Monitoring

2007/08, 2009/10, 2011/12, 2013/14 and 2015/16

Undertake regional energy surveys.

4. Operations

2006/07

Undertake, with involvement of external stakeholders, energy demonstration projects.

The extent to which these initiatives have been carried out is identified in http://www.ecan.govt.nz/NR/rdonlyres/7BAC050D-69FB-424F-AD2B-8082670F4EBD/0/Energy3235.pdf

4.2 Non-statutory energy-related strategies

There are a number of other initiatives in the Canterbury region in which energy is a central theme, or which will influence how energy is used in the region.

4.2.1 Draft Environment Canterbury Energy Strategy 2007 (ECES)

The Environment Canterbury Energy Strategy is a non-statutory document developed by Environment Canterbury. It provides an overview of current and emerging energy issues in Canterbury as at the time of development of the ECES. These include:

- Whilst New Zealand (and Canterbury) is relatively self sufficient in stationary energy supplies, the country (and Canterbury region) is highly dependent on imported fossil fuels for transport.
- Canterbury uses approximately 12% of the nation's consumer energy
- Total energy use continues to increase (3.2% per annum)
- Transport Energy accounts for 60% of the region's energy consumption.
- Canterbury has a higher than national average level of dependency on major transmission and supply system security.
- Emerging environmental issues, such as competition for water resources, could impact on future energy demand and supply opportunities.
- Growth in tourism, business services and export food processing may influence desired levels of energy security.

The Draft ECES lists detailed priority areas for stakeholder action, which were identified in the Regional Energy Forums during 2005. These include:

- Electricity transmission.
- Energy use in existing homes.
- Housing design and subdivisions.

- Urban and rural development and land use.
- Biofuels and biomass.
- Demonstration projects for energy demand reduction.
- Greenhouse gas emissions reduction.

Each priority area has a number of action points. The responsibility for implementing these is unclear, and it is not known to what extent they have been carried out.

4.2.2 Greater Christchurch Urban Development Strategy 2007 (UDS)

The UDS is a partnership between Environment Canterbury, Selwyn and Waimakariri District Councils, Christchurch City Council and Transit NZ. The purpose is to manage Greater Christchurch's growing population over the next few decades. The UDS aims to achieve a more consolidated settlement pattern around the city while providing open space for recreation, improving transport systems and enhancing and protecting environmental quality. While it is primarily to plan for urban development, energy efficiency and reducing energy intensity are explicitly taken into account in designing the UDS actions, such as greater urban densities and energy-efficient housing design.

The UDS was achieved following extensive consultation between the partners and communities. It contains a series of actions aimed at addressing the range of issues that will help develop a more consolidated growth pattern. Partners have committed to giving effect to these actions in various ways including through amendments to policies and plans (e.g. RLTS, CRPS and LTCCPs).

A change to the CRPS is being proposed to take account of the UDS.[14] A separate chapter Development of Greater Christchurch (Chapter 12A) has been included alongside the Settlement and Built Environment chapter (Chapter 12).

Chapter 12A provides the sub–regional policy framework under the Resource Management Act 1991 to implement the UDS. It provides direction for the growth, development and enhancement of the urban and rural areas of the Greater Christchurch sub-region for the period to 2041 and particularly for the period to 2026. The purpose of Chapter 12A is to provide for development in a way that achieves quality outcomes and takes a sustainable development approach to managing growth.

4.2.3 Christchurch Sustainable Energy Strategy 2008-2018 (not an official ECAN document but relevant to this report)

The Sustainable Energy Strategy for Christchurch, produced by the Christchurch City Council, aims to make individuals and businesses more aware of energy issues in Christchurch and to move towards a more sustainable energy system. It is not a statutory document, and the initiatives mainly focus on education and awareness raising. These include:

- Local Energy Agency – a local agency that can coordinate and guide the existing local energy initiatives from the city council, ECAN, EECA, Electricity Commission and Orion.
- Energy Awareness Week – to promote and provide a high profile to energy issues.
- Home Energy Booklets - To bring together a large range of information regarding home energy and 'warm home makeovers'.
- Ongoing Awareness Campaign – Maintain community awareness of energy issues.
- Residential Thermography – Used to identify individual houses or sections of the city that suffer from the greatest heat loss and provides information on best locations for retrofit work.
- School E-Plans – Teaching children about sustainable energy, influencing parental behaviour through children's education and reducing school energy usage.
- Energy Expo Christchurch – Profiles and promotes Christchurch and New Zealand energy businesses and raises awareness of energy issues within the community.
- Identify Top 20 Energy Users – and work with both the energy users and EECA to help categorise the energy use and investigate ways to reduce energy consumption.
- Energy Pledge – directed at all high

[14] The Regional Policy Statement: Proposed Change No.1 Chapter 12A, Development of Greater Christchurch; and Section 32 Report (Link: http://www.ecan.govt.nz/NR/rdonlyres/7C612189-CE48-45C9-8614-4AB0C6B01752/0/RPSProposedChangeNo1FINAL2Notified28July2007.pdf).

industrial and commercial energy users to be good energy citizens.

While the CCC sustainable energy plan is very comprehensive, it is not clearly driven by national policy directions or regional priorities and risks trying to cover too much and achieving few of the actions.

There are a few actions that would be better carried out at the regional level. These include the following;

- Energy monitoring.
- Identification of sites for afforestation for carbon credits.
- Identification of suitable sites for wind, tidal and wave power generation.
- Eco/tourism energy efficiency and renewable fuels use.
- Encouragement and promotion of the use of biofuels.

Each of these activities has real potential to be coordinated across the region with ECan leading and directing in partnership with the other local authorities, business (including the farming community) and community groups. Otherwise there is a risk that dissipation of effort and inefficiencies across activities will occur.

The CCC is an important partner for ECan to work with on implementation of their sustainable energy strategy to ensure its alignment with regional and national priorities. This is because Christchurch is the major population base for Canterbury economic and household activity.

4.2.4 Other regional energy initiatives

Canterbury Regional Energy Forum (CREF)

Environment Canterbury (ECAN), following a series of regional energy seminars jointly facilitated by CAENZ and ECAN in 2005, initiated the Canterbury Regional Energy Strategy Project (CRESP) in 2007. The Canterbury Regional Energy Forum (CREF) was established to oversee the project and currently comprises of ECAN, Canterbury Employers' Chamber of Commerce, CAENZ, Transpower Ltd., Orion New Zealand Ltd. and Meridian Energy Ltd. It is planned that CREF will be expanded in due course to include other regional energy stakeholders.

The objective of the CRESP Project is to develop a road map to secure the future of energy supply in the Canterbury Region. It aims to develop and implement a new paradigm that would facilitate cooperation and collaboration among the key regional stakeholders.

The central components of this new paradigm were:

- a Common Language (to ensure a shared understanding of key criteria and consistency of their use in the strategic and infrastructure investment planning processes);
- a Framework for Collaboration (which would set out a protocol for sharing commercially sensitive information and analysis of the data); and
- a Framework for Communication (to ensure that information related to risks and vulnerabilities of the regional energy system can be communicated to all stakeholders in such a way that they can easily understand what is important and can use the information to make informed decisions, in the face of sometimes conflicting and competing public goals, corporate objectives and multiple responsibilities).

This new paradigm was intended to better incorporate regional opportunities, industry capacities and local needs, and thereby lead to more optimal local energy infrastructure investment solutions and an overall improved energy supply system for the Canterbury region.

Stage 1 of the 3 Stage CRESP Project has been completed, and consisted of a characterisation of the Canterbury regional energy system and some preliminary work to examine relevant issues impacting on the region's future assurance of energy supply. The results of this Stage 1 work have been published as "A Preliminary Stage 1 Report on Energy Security Issues in Canterbury" and as a Pamphlet entitled "Looking after the future The Canterbury Regional Energy Forum". Stage 1 also began to address aspects of the 3 components of this new paradigm, but the development of the new paradigm was intended to be part of a Stage 2 and Stage 3 of the CRESP Project.

Stage 2 of CRESP is expected to commence in the near future, and will examine a regional energy and infrastructure investment opportunities in more detail. This will include assisting ECAN to identify transmission corridors, facilitating local input into regulatory decision making processes, and seeking industry agreement and collaboration to achieve a secure energy supply for the Canterbury region.

Communities for Climate Protection programme (CCP)

ECAN became a signatory to the Communities for Climate Protection programme (CCP) in 2004. The focus is on emissions reduction, and ECAN has carried out an inventory of council's own activities and some other sectors. The CCP programme is not currently integrated with energy initiatives.

However, the CCP programme and the energy strategies are closely related since the majority of the GHG emissions from carbon-based sources come from inefficient energy consumption. The CCP has a very important role to play in holding the GHG inventory which is based on the Regional Energy Survey undertaken by the Council.

The Milestones, Targets and Actions for the CCP need to be aligned with the energy targets and actions and be integrated with the LTCCP via the Annual Plan "Environmental Footprint" which sets out the four Levels of Service[15]. These milestones, actions and targets should all in turn be driven off the national policy signals on energy and climate change using the priority areas as set out above.

[15] Reducing: vehicle carbon emissions, electricity consumption and wste to landfill; and becoming 'carbon neutral'.

5 IS REGIONAL POLICY INTERNALLY CONSISTENT WITH SUSTIANABLE ENERGY OUTCOMES?

This section examines how the statutory regional policies identified in 4.1 provide for or interact in relation to energy issues, with a particular focus on the potential problem types A - C as identified in Section 2:

- Potential Problem Type A: Some policies may result in significant increases in energy use with no consideration for energy efficiency.

  Result: *outcomes not consistent with energy sustainability*

- Potential Problem Type B: Policy documents may fail to address energy issues that are within their domain.

  Result: *shortfall in coverage of issues*

- Potential Problem C: Policy mechanisms in one document could unwittingly produce energy/climate change outcomes that were at odds with the outcomes sought in another document.

  Result: *policy contradictions; unintended consequences*

5.1 Air Policies (NRRP)

Air quality policies that have some relationship to energy are those on transport emissions, home heating and the use of carbon based fuels. Policies to promote reduced emissions from carbon based fuels are generally consistent with sustainable energy outcomes, as this will generally support a reduction of use or more efficient use of fossil fuels. The NRRP policy promotes the use of walking, cycling and public transport and acknowledges the necessity of land use planning in encouraging these forms of transport. This is consistent with transport-related policy in the CRPS and Regional Land Transport Strategy.

Air quality policy is generally not inconsistent with sustainable energy objectives, with the exceptions noted below. The following problems have been identified:

- Air quality policy aims to persuade people to install cleaner forms of heating (flued gas, diesel and electricity) in order to reduce particulate emissions from solid fuel burners. This policy is primarily aimed at replacing solid fuel burners in Christchurch (and later, smaller towns including Timaru and Rangiora) with cleaner heat sources in order to improve air quality standards for public health reasons. However there are also public health issues arising from cold homes, so an approach is needed that addresses both issues simultaneously. For example, there could be more consideration for promoting the use of renewable energy technologies for home heating, e.g. passive solar building design, renewable heating sources. These can assist with achieving both air quality and warm home objectives. The current policy advocates the use of cleaner technologies but does not specifically advocate for the use of renewable technologies for home heating.
  Problem Type B.

- Part of the implementation of this policy is the Clean Heat Project, which provides assistance and subsidies for low-income homes to convert their heating sources to cleaner technologies. This policy implementation, whilst achieving the goals of increasing numbers of clean heating technologies, also impacts on energy policy through the increased use of electricity and gas. The majority of heating conversions have been to heat pumps, resulting in an increase in peak winter electricity demand. This outcome is not necessarily consistent with sustainable energy objectives as it requires increased levels of electricity to be transmitted to Canterbury, affecting transmission constraints, long term grid development plans and potentially electricity prices. The cumulative increased demand over time may lead to the need for more electricity generation.
  Problem Types A, C

- Another interaction of the Clean Heat Project with energy policy is through affordability and wellbeing. There is concern that the movement towards cleaner heating has also led to colder homes with associated health and wellbeing implica-

tions. Low income homes are less able to afford extensive heating by electricity due to the cost leading to compromises between heating and health.
Problem Type C

- Rules around emission-generating activities are not designed to promote energy efficiency, except incidentally in relation to fuel burners in domestic situations via the Clean Heat Project, where only very efficient (and low emissions) solid fuel burners are acceptable. Both commercial and industrial energy efficiency could be considered via regional policy to tie energy policy with air quality more cohesively.
  Problem Type B

5.2 Water policies (NRRP)

Water policy in the NRRP aims to enhance water availability and promote efficiency in the use of water. The following problem Types A - C have been identified.

- For Canterbury to reduce its reliance on imported electricity sources it must consider the development of renewable generation such as hydro. Restrictions on the availability and allocation of water will impact on investors' decisions to build hydro plant. Applications for water permits are processed on a first come, first served basis. If water is largely allocated to irrigation, it may be difficult to get new hydro generation established in the future. Where water availability and consents cannot be certain, investors will chose to undertake alternative investment opportunities and Canterbury may miss out on much need generation investment. This issue may need to be more explicitly addressed in policy.
  Problem Type B
- Hydro generation plant also impacts on water quality as damming rivers changes the flow characteristics altering the ecosystem of rivers. Policy regarding water quality standards may impact on the ability to develop hydro generation.
  Problem Type C
- Irrigation levels on the Canterbury plains have increased hugely in the last decade. The result is a high (and increasing) peak energy demand in Canterbury during the summer and reduction in water availability for other purposes. The increased irrigation levels have the ability to change the electricity demand profile for the region affecting transmission utilisation, electricity prices and long term transmission/generation plans. The implications of irrigation on energy policy may be exacerbated in the future due to climate change and its potential effects on water demand and supply. Water use efficiency is one of the decision-making criteria for resource consents, but consideration should also be given to adding a further criteria relating to the efficient use of the energy used for irrigation systems.
  Problem Types A, B and C
- Water harvesting and storage, which is potentially more energy efficient than continual pumping, is not explicitly encouraged although it does encourage storage of water taken at high flows for later use.
  Problem Type B
- Policy could also potentially encourage dual use of water for both irrigation and energy generation.
  Problem Type B

5.3 Land Use policies (CRPS)

The CRPS land use policy relates well to energy sustainability in that it promotes efficient use of energy resources, efficient use of transport networks, and development of appropriate land use corridors for the promotion of alternative transport modes.

The following Type B problem has been identified.

- The greater portion of Canterbury is heavily dependent on transmission of electricity from the large hydro generators in South Canterbury and Otago or from the North Island via the DC link to Benmore, again in South Canterbury. As electricity demand increases transmission upgrades and new lines will be required. Policy surrounding land use and transmission corridors could give better consideration of future land requirements and allocate land ahead of time to prevent unsuitable development. This has the potential to make consenting processes faster and provide more certainty for investors in the grid.
  Problem Type B

The CRPS has the potential to take a stronger

lead in promoting consideration of energy issues in land use planning (particularly at district plan level). This will be discussed further in sections 6 and 8.

5.4 Transport Policies (CRPS and RLTS)

The focus of transport policy is predominantly on economic development rather than energy efficiency. Policy aims of promoting alternate low emission transport modes (e.g. walking, cycling and public transport as well as reducing transport demand) align well with energy sustainability regarding reduction in carbon emissions and increasing efficiency use of energy.

- A potential problem arising from the economic development focus of transport policy, is that economic growth has traditionally almost always been supported by a growth in energy use (including freight transport). This may counteract achieving more efficient energy use, and a stronger emphasis may need to be placed on reducing energy intensity and so decoupling this linkage.
  Problem Type C

5.5 Regional Development Policies (LTCCP)

- The four LTCCP Community Outcomes presume a secure and affordable supply of energy, particularly the economic prosperity objective. If the region promotes growth with no consideration for energy supply and demand patterns, this may result in significant increases in energy use.
  Problem Type A
- As with 5.4 above, economic growth has traditionally almost always been supported by a growth in energy use. A stronger emphasis may need to be placed on reducing energy intensity and so decoupling this linkage.
  Problem Type C

6 DOES REGIONAL POLICY TAKE AN INTEGRATED APPROACH TO ENERGY ISSUES?

This section discusses findings in relation to Potential Problem Type D - lack of an integrated approach. While each document is able to influence part of the 'energy puzzle', as a whole they may not necessarily address energy issues in an integrated way. Result: *fragmented approach, gaps in policy coverage, flawed policy*

The key themes of the draft Environment Canterbury Energy Strategy, and similarly the new strategic policy environment, can be expressed as three overarching objectives:

- Greater efficiency and less intensity in all types of energy use;
- Greater emphasis on renewable forms of energy; and
- Resilient, low-carbon transport.

This section takes each objective and reviews whether ECAN's policy documents address these in an integrated way, and whether there are any obvious gaps in policy coverage.

6.1 Energy efficiency and energy intensity

There are a number of Type-D problems relating to achievement of greater efficiencies and reduced energy intensity.

- Currently it appears that energy efficiency in residential housing is addressed in a fragmented and sometimes inconsistent way between the CRPS and NRRP Air Quality section. To achieve greater energy efficiency in residential housing, changes may need to be introduced into the CRPS and Air Plan, and subsequently into District Plans. The changes should encourage best practice new house design and orientation, encourage energy-efficient renewable technologies, and ensure unintended consequences (Type C problems) do not arise from imposing rules relating to air quality.
- Irrigation is another major energy user. As noted previously, the NRRP provisions can address efficiency of water use but not efficiency of energy use in irrigation systems. Policy signals may be required in the CRPS and also NRRP to address this.
- In relation to energy efficiency in transport, the focus of transport planning appears to be primarily on achieving a high level of service for vehicles through reducing congestion. Internationally it has been found that any move to free up congestion has led to an increase car use and thus fossil fuel energy use.[16] Other modes, which may be less energy intensive, (e.g. cycling, public transport) are not necessarily prioritised. A change of focus to encourage the more energy effective transport options should be supported by a policy review across land use and transport policies to ensure a consistent approach.

6.2 Renewable energy

The following Type-D problems were identified relating to renewable energy:

- Hydro generation – while the NRRP protects existing hydro generation, there appears to be no acknowledgement of the potential for new hydro generation. The NRRP and WCP make provision for micro-hydro up to a certain scale but this could be reviewed to see whether the scale limits are appropriate. Consideration could also be given to encouraging dual use of water, for both hydro generation and irrigation, even at a small scale.
- Marine energy – this is still in the development stage but it would be useful to consider whether this should be referred to in the Coastal Plan when it is next reviewed.
- Energy from waste/biomass – establishing new plant is likely to require land use, air and water consents. If the region wishes to encourage this activity it may be useful to ensure a consistent approach across all plans, with maybe the CRPS establishing an

[16] P Newman & JR Kenworthy, 1999. *Sustainability and Cities: Overcoming Automobile Dependence*, Island Press, Washington DC.

overarching policy position.

- Biofuels – if biofuels do become a viable alternative there may be a move to use significant land areas to grow suitable biomass crops. This change could have implications for land use, water and ecological values, and policy guidance may be needed in the CRPS, NRRP and district plans.
- Building design - there could be more policy consideration for promoting the use of passive solar design and active solar technologies (solar hot water heating, active solar thermal space heating) for home heating. This could be promoted at CRPS level, implemented through district plans, and encouraged through education and demonstration projects through the LTCCP.
- Wind – increasingly, wind-farms proposals are leading to conflicts over landscape values. ECAN could take a lead role in resolving these conflicts and uncertainties by carrying out a region-wide identification of non-sensitive (or sensitive) landscapes in which wind-farms would (or would not) be encouraged, and including this in the CRPS. This could be implemented through district plans.
- Distributed generation (small-scale, localised renewable energy systems) is not specifically identified in any policy documents except for micro-hydro in the NRRP. These small-scale systems may be viable for individuals or communities seeking greater local energy resilience, and also will reduce load on the grid. The CRPS could signal encouragement of such systems in appropriate circumstances. This could be implemented through district plans and through demonstration projects.

6.3 Resilient low-carbon transport

The following Type-D problems were identified relating to transport.

- Location and density of population and services have a significant influence on transport systems. The UDS sets out to achieve a more compact urban form (and thus more efficient and resilient transport systems in the long run) for Greater Christchurch, but other parts of Canterbury (e.g. Ashburton, Timaru) do not have similar strategic goals. This may need to be addressed through a similar integrated strategic approach for these outlying parts of the region.
- ECAN is responsible for managing public passenger transport services in the region. A greater uptake of low-carbon fuel options could be achieved by clear policy signals in the CRPS, RLTS and LTCCP, backed up by implementation mechanisms (e.g. electric buses, higher biodiesel substitution for buses).
- An integrated approach to land use and transport planning is needed to achieve a real shift to other transport modes, including for freight. Consideration should be given to what role ECAN could play in leading an integrated approach in all parts of the region. This may involve developing a consistent approach across the CRPS, RLTS, NRRP, LTCCPs and District Plans.

6.4 Other Issues from the New Zealand Energy Strategy

Other national energy issues not specifically covered in regional policy documents include Security of Electricity Supply, Sustainable technologies and innovation and Affordability and Wellbeing. These are generally relevant at a national level, but consideration could be given at a local level as to how current policies might affect these goals (e.g. preventing development of more sustainable technologies by using blanket bans on wood combustion heaters, removing affordable heating options for low income families).

Awareness must also be maintained of national level policy development and how it might affect the Canterbury region. An example of this is the demand models used by the Electricity Commission and Transpower in determining need for transmission upgrade requirements for Canterbury. The base assumptions used may have a serious impact on electricity supply for the Canterbury region.

7 IS REGIONAL POLICY CONSISTENT WITH THE NEW STRATEGIC POLICY ENVIRONMENT?

Potential Problem Type E was that policy documents are outdated. This would occur if regional policy documents were developed prior to the many recent changes in national-level policy relating to energy, including

- National policy introduced 2007-8 (NZES, NZEECS, UNZTS etc)
- New National Policy Statement on Electricity Transmission (2008)
- Changes to the RMA (effective from 2 March 2004) which inserted sections 7(ba) *the efficiency of the end use of energy*, and 7(j) *the benefits to be derived from the use and development of renewable energy* into Part II RMA.

Result: plans and policies out of date, lack of relevance to current issues.

It is apparent that **most** of the statutory regional policy documents had been developed prior to all of these recent changes in the strategic policy environment. The NRRP, RLTS and LTCCP have all been developed prior to 2007. The NRRP appears to have been developed without consideration of the changes to section 7 RMA. The scope of the current proposed changes to the Canterbury Regional Policy Statement could potentially go a long way towards addressing these Type-E problems.

The scope of this report does not enable identification of all specific implications, but two examples are:

- the RLTS does not consider the impact of a significant move to electric vehicles
- the CRPS does not yet recognise the NPS directive that regional councils must facilitate long-term planning for investment in transmission infrastructure.

In failing to reflect the new strategic policy environment, the regional-level plans and policies may (a) be ill-equipped to deal with upcoming trends, (b) be inconsistent with national policy directions and initiatives, and (c) exacerbate undesirable energy and climate change trends.

This highlights the problem of the inertia associated with the statutory policy process. The policy review cycle does not appear to be fast enough to keep in step with the current (and rapidly changing) environment that the policies operate within. This would seem to have serious implications with regards giving effect to national policy objectives as well changing regional realities.

8 RECOMMENDATIONS

If secure, affordable and sustainable energy is perceived to be a key strategic issue for Environment Canterbury, it is important that the various plans and policy documents that affect energy supply and demand work together in an integrated and consistent way to achieve the desired outcomes.

As the draft Environment Canterbury Energy Strategy recognises, energy generation, transmission and use is of fundamental importance to all of the region's activities. The title of the draft ECES suggests a suitable high-level outcome – "towards an affordable, reliable, resilient and sustainable energy system for Canterbury" – but to achieve such a vision, an integrated approach is required across all of ECAN's policy and planning documents.

The most important challenge is to develop a widely accepted strategic approach to energy in the Canterbury region. This can be potentially addressed through both statutory and non-statutory policy. In a paper on the Greater Christchurch Urban Development Strategy, the Chief Executive of ECAN[17] highlighted the usefulness of facilitating direct community participation in a non-statutory planning process, the outcomes of which are then given backing through revisions to statutory plans (e.g. Regional Policy Statement, regional and district plans). Such an approach would seem to provide a positive, collaborative environment within which to develop an effective approach to regional energy issues.

Some progress has been made in this direction with the formation of the Canterbury Regional Energy Forum (CREF), initial studies to better define the current energy situation and opportunities, and the draft Environment Canterbury Energy Strategy. Further progress can be made through implementing the recommendations below.

[17] Giving Statutory backing to non-statutory strategies through regional policy statements, A case study of the urban development strategy for greater Christchurch, Dr Bryan Jenkins, Chief Executive, Environment Canterbury.

Recommendation 1: Develop an overarching non-statutory Regional Energy Strategy

A more consistent, integrated approach towards energy sustainability across all of ECAN's policy instruments could be achieved through developing an agreed non-statutory Regional Energy Strategy in consultation with stakeholders. The current CREF would be a good starting point but wider consultation may be required, particularly including user groups.

To be effective, the ECES would need to be a high-level strategy that was given effect to through the various relevant statutory documents produced by ECAN (LTCCP, CRPS, NRRP, RLTS) and District/City Councils (District Plans, LTCCP's). In this way it would be implemented in a similar way to the current Greater Christchurch UDS. Figure 2 shows schematically how this could work.

The Regional Energy Strategy could build on the work done in developing the current Draft Environment Canterbury Energy Strategy, but it might be constructed to contain less detail and focus on high-level objectives. It should be consistent with the new national strategic environment (see section 3), take into account current trends and build on knowledge of the region's current energy situation (see Appendix A).

This non-statutory document, with agreed targets and actions, could then form the basis of reviews of other statutory policies and plans (as in Fig 2) which affect energy use and energy generation.

Progress towards this goal has occurred with the development of CREF (see section 4.2.4), and the Canterbury Regional Energy Survey in reviewing the energy scene and opportunities in Canterbury, but the next stage in engagement with broader stakeholders has yet to occur.

It should be noted that the development of regional energy strategies is specifically encouraged in the NZEECS (p73).

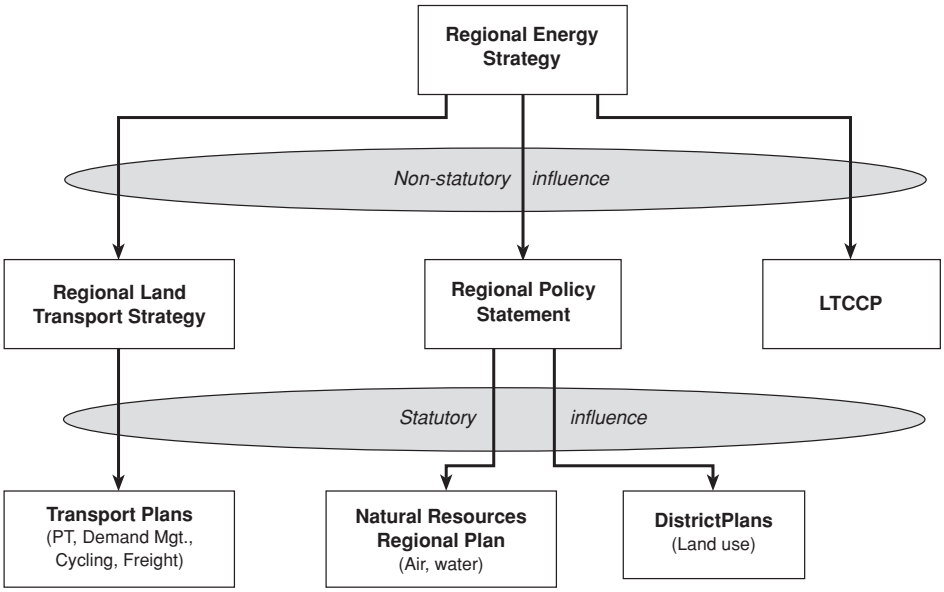


Figure 2: Schematic of how a Regional Energy Strategy could be implemented through statutory planning mechanisms

Example: Waikato Draft Regional Energy Strategy

An example of such an approach is the Waikato Draft Regional Energy Strategy. Led by Environment Waikato to inform regional policy development, this is a good example of a cohesive and detailed regional energy strategy. The Waikato Draft Strategy was produced after the release of the New Zealand Energy Strategy and is therefore more up-to-date than many of the Canterbury regional policy documents outlined previously.

The Waikato Draft Energy Strategy identifies the need for a regional energy strategy based on the region's unique geography, weather and rainfall patterns, industry, population and available resources. The strategy identifies the national level policy documents such as the NZES, NZEECS, NZETS and NZTS that will influence and shape the development of regional level energy policy. The national level policy documents are examined and the impacts of these policies on the Waikato region are investigated. As part of the strategy the existing energy supply and demand profile for the region is detailed. This provides an in depth view of the composition of energy supply including both imported and regionally produced energy. The demand profile of the region gives information regarding the major users and categories of energy use such as heating, industrial, transport etc.

The strategy identifies the important focus areas for energy policy and planning based on impacts of national policy and competing regional policy. These focus areas feed into the recommendations to guide future planning and improve energy resilience of the region. Examples of some of the recommendations include:

- Building sufficient electricity capacity to supply demand
- Identifying and ensuring obligations to remote customers are met
- Supporting various generation technologies including coal, wind, hydro, solar, marine and biomass through consideration in the regional policy statement.
- Increasing the number of tradespeople capable of working with renewable energy systems
- Promotion of energy efficiency
- Clarification of consenting processes, particularly in respect of distributed generation.

Recommendation 2: Lead through the Regional Policy Statement

Developing an agreed non-statutory Regional Energy Strategy may take some time, as stakeholders will need to be brought together to reach agreement on the way forward. However, there are many other actions ECAN can take within its own statutory jurisdiction within a shorter timeframe. Implementing a review of the CRPS could occur relatively quickly, particularly where issues need urgent attention.

Alternatively, should ECAN decide not to develop a non-statutory strategy, the CRPS could be the lead document for an integrated energy strategy. In particular, the CRPS could have a key role in leading an integrated management approach throughout the region, and in guiding the development of district and regional RMA plans, which must 'give effect to' the CRPS.

The CRPS requires review in light of the 2004 introduction into Part 2 RMA of sections 7(ba) (the efficiency of the end use of energy), and 7(j) the benefits to be derived from the use and development of renewable energy. The RMA requires that the CRPS must be prepared and changed 'in accordance with [amongst other things]... the provisions of Part 2' (s61(1) RMA). Additionally, the new National Policy Statement on Electricity Transmission (2008) must be given effect to in the CRPS (s61(3) RMA). The upcoming National Policy Statement on Renewable Electricity Generation may also lead to the need to review the CRPS.

More generally, a review of the CRPS could also take into account the new strategic policy environment and the significant energy-related resource management issues for the region. The rate of change of the energy situation, and current trends, suggest the need for a speedy but informed review of the CRPS.

As noted earlier, the scope of the currently proposed changes for the CRPS takes a positive lead in this direction.

Recommendation 3: Identify and address inconsistencies, omissions, policy contradictions, unintended consequences and policy shortfalls across all of ECAN's plans and policies.

This report has identified a number of Type A-E problems within and amongst ECAN's CRPS, NRRP, RLTS and LTCCP, as detailed in sections 5-7.

Given the narrow scope of this review, it has not been possible to carry out a fulsome and detailed analysis of every policy and there may well be many other examples of such problems. A more detailed review is required, followed by the development of specific recommendations as to how these inconsistencies, omissions, policy contradictions, unintended consequences and policy shortfalls could be dealt with. Following this, it is likely that ECAN will need to formally review the relevant plans and policies, and introduce plan changes.

The following is a suggested checklist of questions for evaluating current and future policy documents for consistency in approach to energy issues:

- What energy forms are used in policy area? (e.g. irrigation uses gravity fed systems or electric water pumps).
- What is the purpose of the energy use? (e.g. home heating providing wellbeing and health benefits).
- Have/should other options be considered? (e.g. cost/benefit issues).
- What effect do these energy forms have on the environment? (Land use, air, water, and emissions (greenhouse gases, particulates, pollutants)).
- Are the energy options sustainable and affordable? (e.g. promotion of more efficient energy options may also cause a reduction in the benefits by swapping to more expensive energy forms and causing long term security of supply issues by increasing demand).
- Are the energy options efficient? (e.g. the use of second hand plant vs new more efficient plant on a cost basis).
- Are best practice energy management principles applied? (e.g. has effort been applied to ensure energy is not excessively wasted in meeting the desired outcomes? Consider the efficiency of the energy transformation as well as the efficiency of the process it drives).
- Is a fossil fuel substituted with net gain? (e.g. replacement of fossil fuel with a more sustainable option, but with higher emis-

sions or different emissions)

- Is there a net community gain? (e.g. issues of increased security of supply, improved service delivery)
- Have cogeneration opportunities been evaluated? (e.g. power & heat generation or electricity generation in tandem with irrigation systems)

Recommendation 4: Gathering good data to support informed policy development.

To achieve better integration across the policies, it would be useful to identify the major energy users, and user groups, across the region, how and where energy is used, and the degree of energy management that is practiced by these users. After identifying the activities where significant improvements of energy use practices can be made, plans and policies that affect these could be reviewed to ensure appropriate and consistent provisions are introduced to support greater energy efficiency (eg the significant gains that can be made by thermally insulating houses to reduce the energy requirements for heating).

The data would also help identify potential impacts of other policy decisions that indirectly, or directly, impact upon current energy usage (eg clean air policy).

ECAN has a good basis with its Canterbury Regional Energy Survey 1982 – 2006[18], but to be of use for policy development, some of the data needs to be presented in different forms and further analysis would be required. A review of these needs is currently ongoing.

[18] Canterbury Regional Energy Survey 1982 – 2006, ECAN Report No. R08/14, ISBN 978-1-86937-776-2.

APPENDIX A: A REVIEW OF CANTERBURY'S ENERGY SITUATION

This review used the data from the recent Canterbury Regional Energy Survey[19]. This report shows energy consumption trends from 1982 to 2006, updated at two-yearly intervals. The following is an excerpt from the Report's Executive Summary.

The focus of the survey and of the report was on the consumption of energy. A supply-side description and perspective of energy in Canterbury can be found in "CRESP: A Preliminary Stage 1 Report on Energy Security Aspects in Canterbury".

Key Findings

Total energy use plateaus

Total energy consumption in Canterbury showed a slight decline (an average decrease of 0.1 % per annum) over the survey period (2004 to 2006). This is in contrast to the long-term trend for energy consumption, which since 1982 has risen at an average rate of 2.6 % per annum (See Figure I below). And in contrast to the national trend which showed an increase in total consumer energy for oil from 2005 to 2006 of 1.2%

This observed decline was the result of a reduction in the consumption of oil products in the Canterbury region. Oil products contributed 62 % of total energy consumption and for the survey period declined at an average rate of 1.2 % per annum.

The decline in energy consumption despite an increasing population in the region means that the energy consumption per capita also declined during the survey period.

Domestic energy use is the fastest growing

While energy consumption in the transport sector and the industrial/commercial sector remained stable or declined over the survey period, domestic energy consumption increased by 2.2 % per annum (this is higher than the long-term average of 1.2 % per annum). Also in comparison, domestic energy consumption of electricity has been stable for the past 30 years per household nationally. The slow-down in energy consumption by both the transport and industrial/commercial sectors is due to a reduction in the consumption of oil products; this may be partly in response to recent increases in oil prices.

Diesel is now the main type of vehicle transport fuel

2005 was the first time that the survey recorded vehicle diesel consumption at a higher level than vehicle petrol consumption. In the Canterbury region the two major consumers of diesel are agriculture and freight; the increase in diesel consumption suggests that either or both of these sectors have experienced reasonable growth over the last few years.

CO_2 emissions decreasing

A decline in the consumption of oil products has resulted in an equivalent decline in CO_2 emissions. During the survey period emissions in the Canterbury region were calculated to have decreased by 1.1 % per annum. In 2006 transport was the major emission source in the region, responsible for 82 % of oil products and coal related emissions; 69 % was from the Canterbury vehicle fleet, with the balance from air transport and marine transport.

It is important to note that emissions were only calculated for coal and oil products. The analysis does not take into account carbon emissions from other sources such as non-renewable electricity (which are assumed to be minimal), nor from non-energy sources such as deforestation and agriculture.

Conclusion

The results presented in all regional energy surveys prior to this one illustrated an overall

[19] Canterbury Regional Energy Survey 1982 – 2006, ECAN Report No. R08/14, ISBN 978-1-86937-776-2.

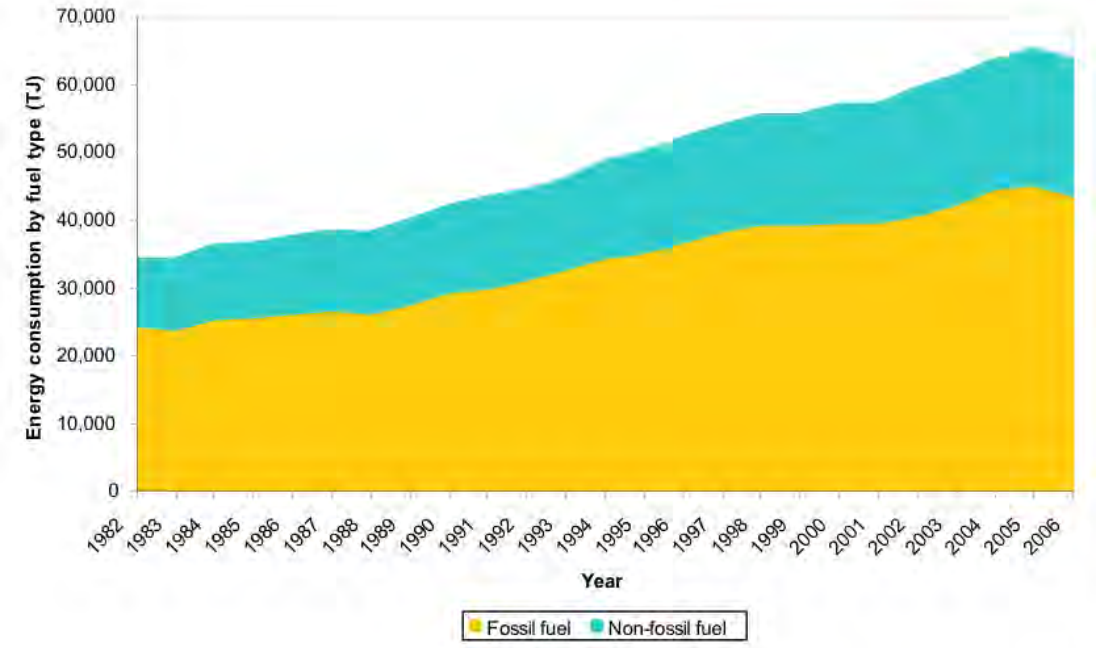


Figure A1: Canterbury energy consumption by fuel origin

trend of increasing regional energy use and a dependence on imported oil products. The results in this survey depart from this trend; they show a noticeable decline in the use of oil products in the region for 2006. At present it is uncertain whether this decline could be representative of a stabilisation in energy use, in response to increasing cost and uncertainty over oil supplies, or a short-term effect.

In contrast the consumption of electricity in the region over the survey period continued to grow at a rate similar to the long-term average.

Selected Survey Data

The majority of energy consumed in Canterbury comes from fossil fuels, contributing 68% of total energy. The relative contribution of fossil and non-fossil fuels has remained relatively constant throughout the survey's history.

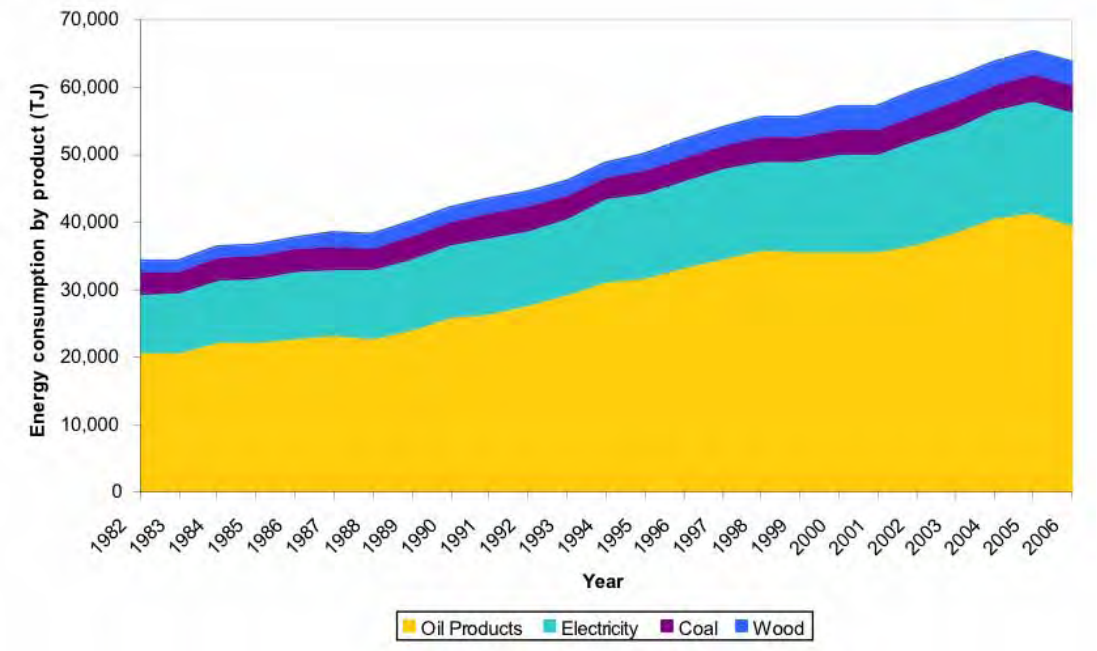


Figure A2: Canterbury energy consumption by product

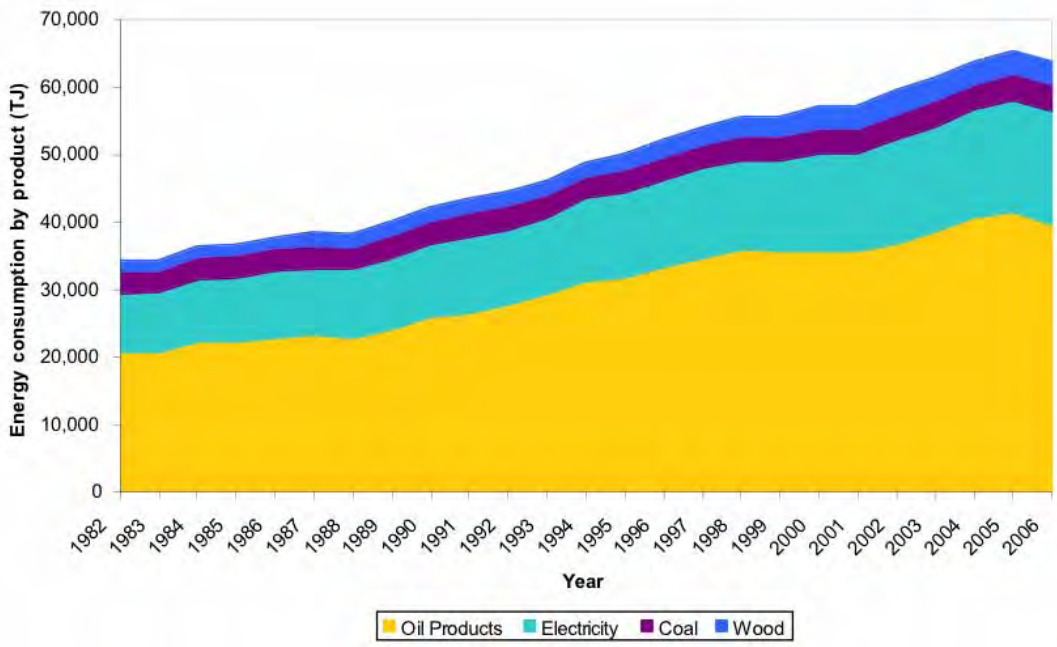


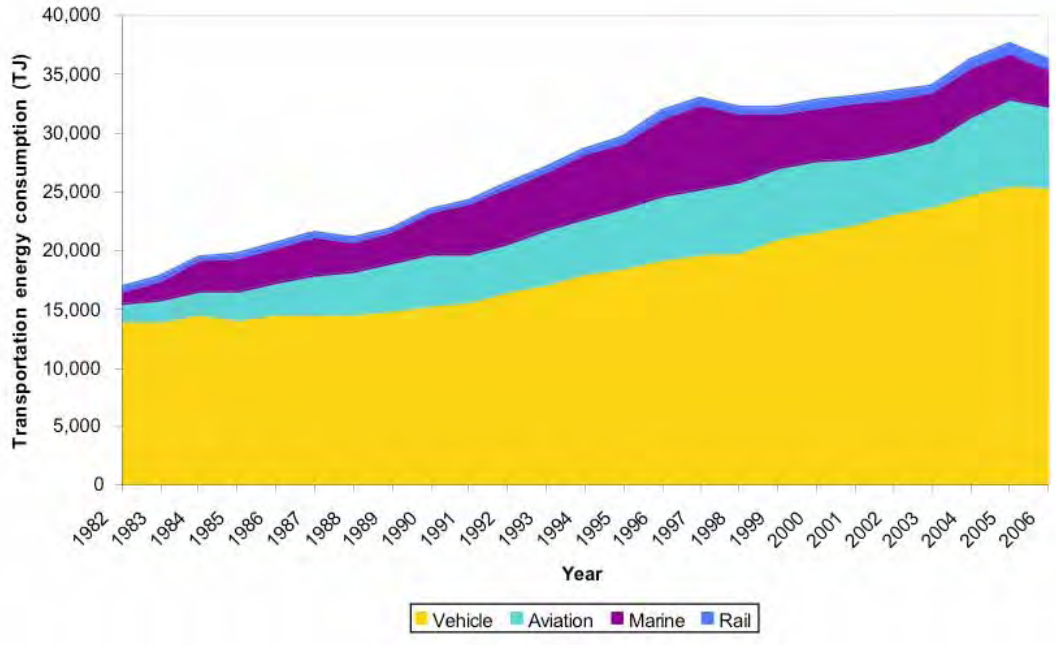
Figure A2: Canterbury energy consumption by product

The Canterbury region's energy consumption patterns and levels are broadly similar to national patterns and levels, with some difference noted below. A higher level of electricity consumption per capita substantially compensates for the non-availability of reticulated natural gas in the South Island.

Total energy consumption in the Canterbury region remained relatively stable, declining over the 2004-2006 period by 0.1 % per annum. This decline was due a decline in oil consumption over the survey period of 1.2 % per annum. In contrast, electricity consumption increased at 2.4 % per annum.

Oil products accounted for 62 % of energy consumption in 2006.

Canterbury's sectoral consumption patterns are slightly different from the national level. These differences are consistent with expectations.



FigureA4: Canterbury transportation energy consumption

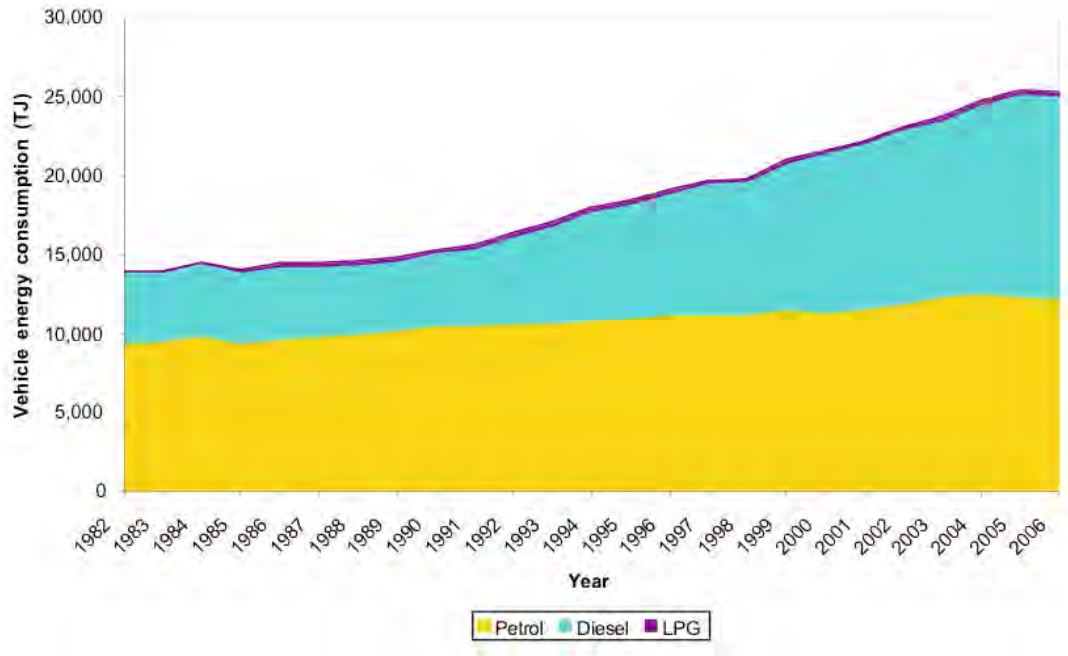


Figure A5: Canterbury vehicle energy consumption by product

Cantabrians consume, hence spend, much more on transport energy than the national average. The industrial/commercial energy share per capita in Canterbury is lower than nationally and there is slightly higher domestic consumption per capita.

Over the survey period (2005 to 2006) energy consumption in the transport sector remained constant. Energy consumption by the industrial/commercial sector was observed to decline by 1.7 % per annum while domestic energy consumption increased by 2.2 % per annum.

In 2006 the energy consumption of road transport, aviation and marine were all observed to decrease. However, over the two-year survey period only marine energy consumption actually decreased, at a rate of 14.9 % per annum. For vehicle and aviation energy consumption the decrease in 2006 was not large enough to offset the increase in use in

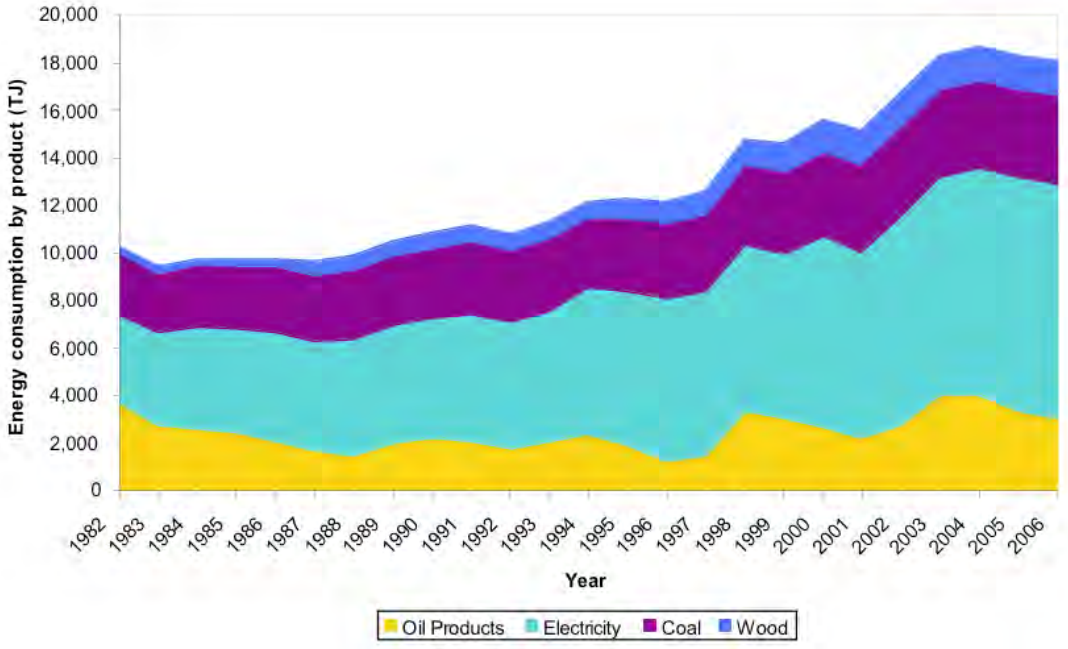


Figure A6: Canterbury industrial/commercial energy consumption by product

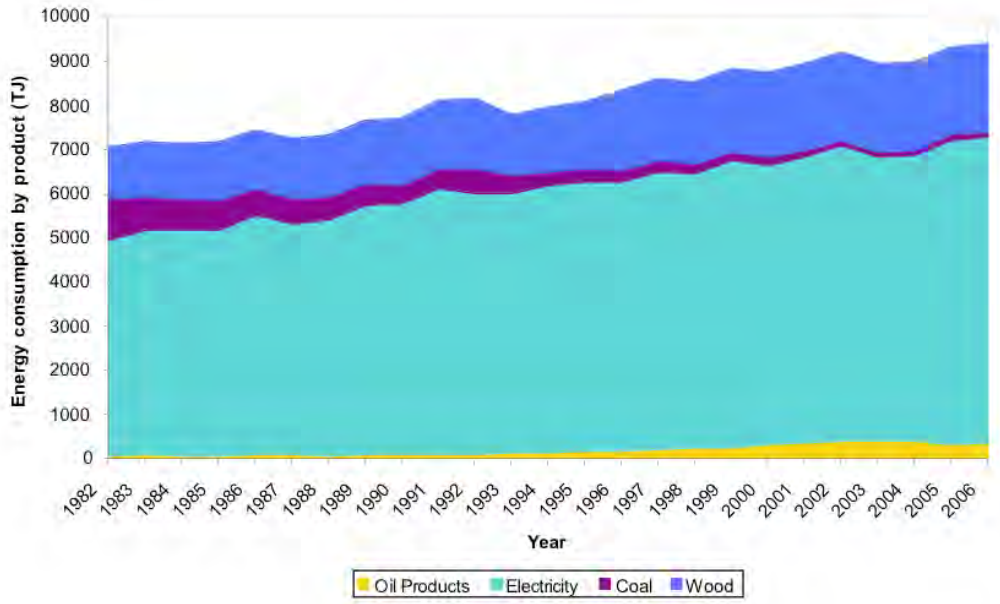


Figure A7: Canterbury residential energy consumption by product

2005. Although these changes appear, and may well be, significant, volatility of the marine energy series of this extent has been observed since the beginning of the series in 1982. Energy consumption for rail increased over the survey period at a rate of 17.9 % per annum.

Road transport was the major consumer of total transport energy accounting for 70 % in 2006.

Petrol consumption was observed to decline annually by 1.6 % over the survey period. In contrast, vehicle diesel consumption increased, with an average annual increase of 3.9 % across 2005 and 2006, comprising an 8 % increase in 2005 and a small decline in 2006.

2005 was the first time that the survey recorded vehicle diesel consumption at a higher level than vehicle petrol consumption.

Energy consumption for each energy commodity has been divided into industrial/commercial and residential use. As this split was based on

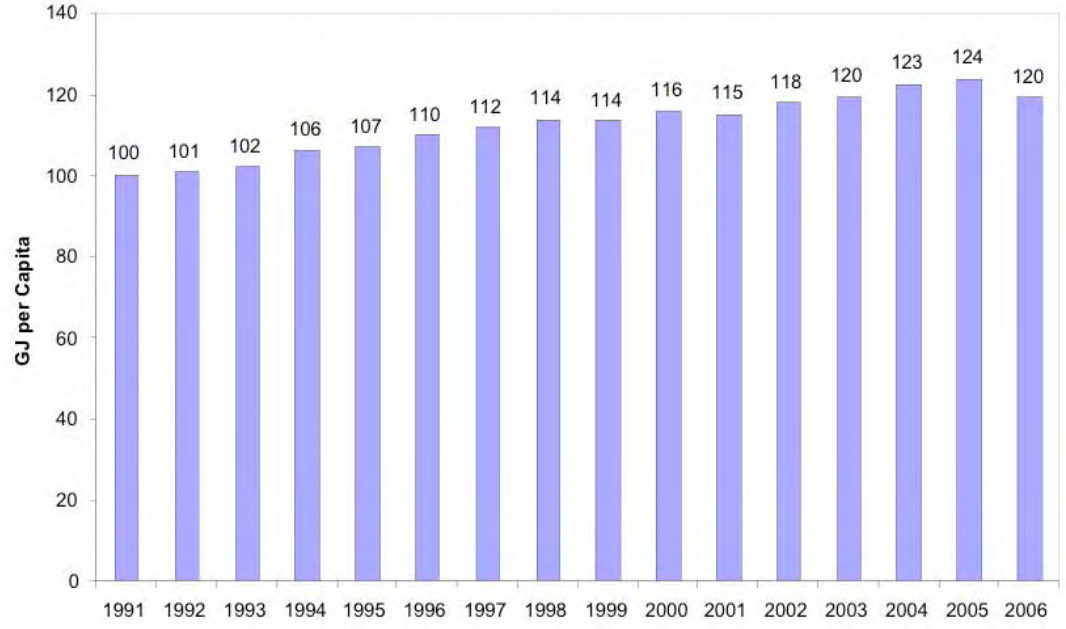


Figure A8: Canterbury energy consumption GJ per capita

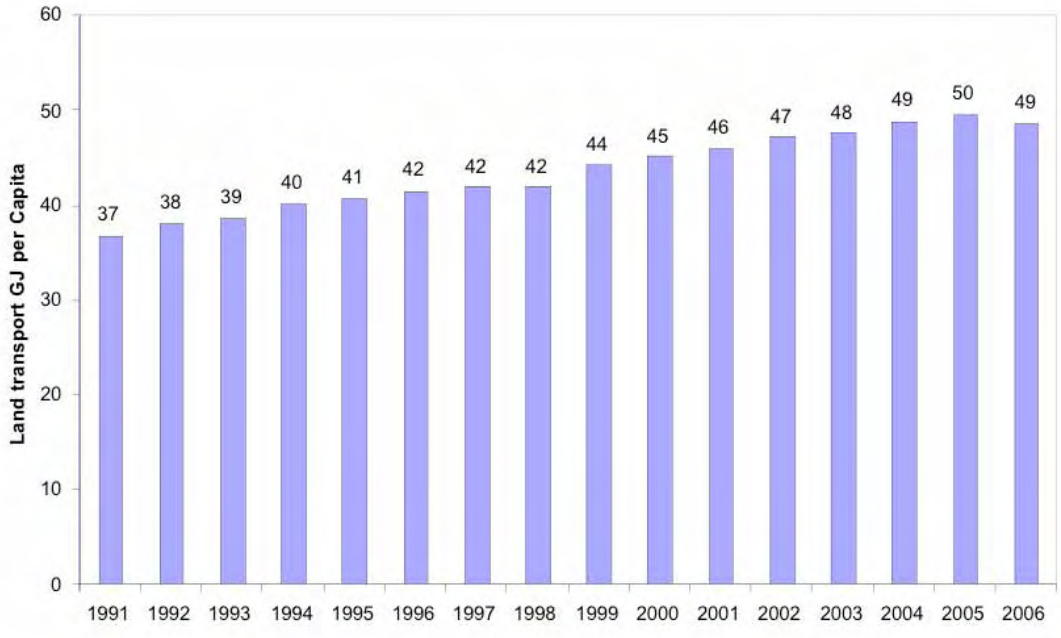


Figure A9: Canterbury land transport energy consumption GJ per capita

assumptions that are now dated the resulting information may not accurately reflect the current situation. However the data is useful for identifying trends in the relative importance of each energy commodity for each sector. The data indicates that electricity is the dominant type of energy consumed in both the industrial/commercial and residential sectors.

A decline in GJ per capita was observed in 2006 for both energy consumption per capita and land transport energy consumption per capita. In both cases GJ per capita peaked in 2005. This observed slow down is due to a plateau in energy consumption across the Canterbury region despite an increasing population.

CO_2 emissions declined over the survey period by 1.1 % per annum. As coal consumption was assumed not to have changed over the survey period, and as wood and electricity are

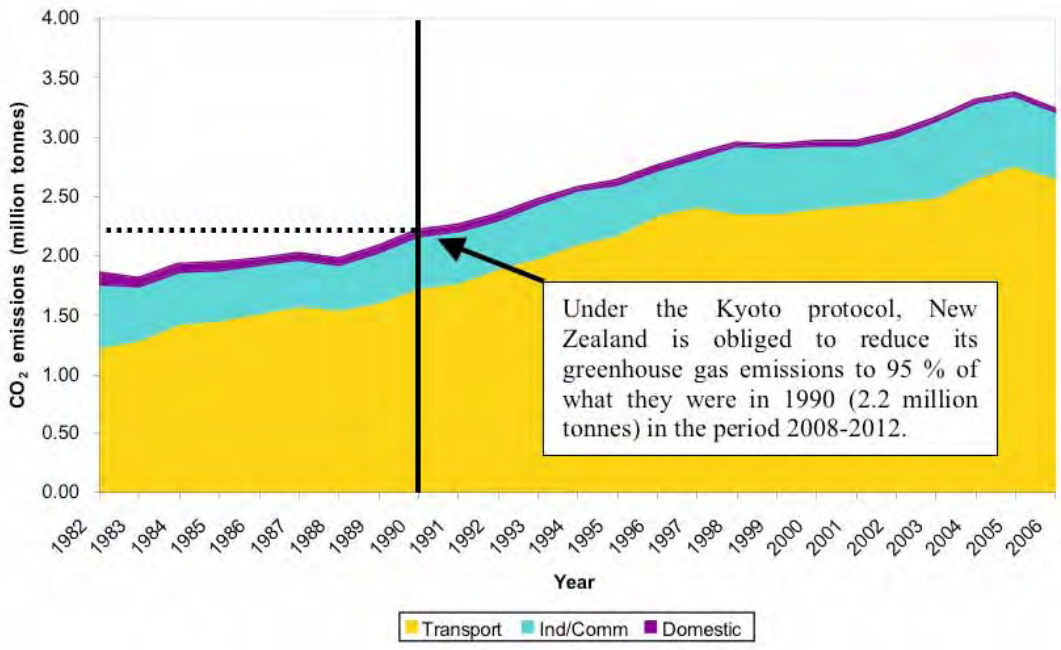


Figure A10: Canterbury CO_2 emissions per sector

considered not to emit greenhouse gases, CO_2 emissions were observed to track oil product consumption[20]. It was calculated that in 2006 CO_2 emissions totalled 3.25 million tonnes. This represents as increase of 48 % over the international benchmark figure for 1990.

In 2006 transport contributed 82 % of CO_2 emissions from oil products in the Canterbury region. Furthermore, 69 % of the transport emissions were produced from the Canterbury vehicle fleet (aviation was the second largest contributor).

[20] In the estimation of CO_2 emissions it is assumed that all carbon in fuel in converted into CO_2. Also CO_2 equivalent effects of other greenhouse gases have not been taken into account.